

REMARKS

Applicant has amended claim 19 and added new claim 30. No new matter has been added as a result of these amendments.

Allowed Claims

Applicant notes that the Examiner allowed claims 1-4 and 7-9 in the Final Office Action mailed July 16, 2002.

Claim Rejections – 35 U.S.C. §102/103

Andricacos

Claims 10 and 12-16

The Examiner has rejected claims 10 and 12-16 under 35 U.S.C. § 102(e) as anticipated over Andricacos et al., (US Patent 6,268,291).

It is Applicant's understanding the cited reference fails to teach Applicant's invention as claimed in claims 10 and 12-16. In independent claim 10, Applicant claims a method of forming a copper alloy layer comprising plating a layer of copper over a substrate and then implanting a least one dopant element selected from the group consisting of aluminum (Al), magnesium (Mg) and tin (Sn) into the plated copper layer. Applicant understands Andricacos to teach a method of forming a copper conductor where non-metallic impurities selected from the group consisting of carbon (C), oxygen (O), chlorine (Cl), sulfur (S) and nitrogen (N) are first implanted into a main copper conductor 90/100 and then aluminum, tin, indium, titanium and chromium ions are implanted as a secondary surface modification step (Col. 12, lines 58-67). As such, Andricacos describes implanting aluminum, tin, indium, titanium and chromium ions

into a previously implanted copper layer and not into the plated layer as claimed by Applicant.

Additionally, with respect to claim 13-15, the Examiner has equated Applicant's claimed barrier layer formed over the interconnect lines prior to or after implanting to Andricacos' barrier layer 94. Contrary to the Examiner's statement, barrier layer 94 of Andricacos is not formed over copper interconnect 90/100. (See Figure 4B and Figure 5B). Andricacos' layer 94 is deposited prior to deposition of all of the copper layers.

Further, claims 12-16 depend from claim 10. For at least the same reasons as mentioned above, Andricacos fails to teach Applicant's invention as claimed in claims 12-16.

For the above-mentioned reasons, it is Applicant's understanding that Andricacos fails to teach Applicant's invention as claimed in claims 10 and 12-16. Applicant therefore respectfully requests the removal of the 35 U.S.C. § 102 rejection of claims 10 and 12-16 and seeks an early allowance of these claims.

Claims 17-18

The Examiner has rejected claims 17-18 under 35 U.S.C. § 103(a) as being unpatentable over Andricacos et al., (US Patent 6,268,291).

Claims 17-18 depend from independent claim 10. Thus, for at least the same reasons discussed above, Andricacos does not render obvious Applicant's invention as claimed in claims 17-18. Applicant therefore respectfully requests the removal of the 35 U.S.C. § 103 rejection of claims 17-18 and seeks an early allowance of these claims.

Havemann/Havemann in view of Chiang

Claim 19

The Examiner has rejected claim 19 under 35 U.S.C. § 102(e) as anticipated over Havemann et al., (US Patent 6,130,156).

It is Applicant's understanding that Havemann fails to teach Applicant's invention as claimed in claim 19. In claims 19, Applicant claims a method of forming a copper alloy. According to Applicant's claimed method, a seed layer is deposited on the substrate, wherein the seed layer comprises copper and at least one dopant element selected from the group consisting of aluminum (Al), magnesium (Mg), and silicon (Si). It is Applicant's understanding that Havemann teaches forming a doped layer 29 with tin (Sn) as the dopant (Col. 5, lines 1-11 and 39-43). Havemann fails to teach forming a layer with dopant selected from the group consisting of aluminum, magnesium, and silicon.

As such, it is Applicant's understanding that the Havemann reference fails to teach Applicant's invention as claimed in claim 19. Applicant therefore respectfully requests the removal of the 35 U.S.C. § 102 rejection of claim 19 and seeks an early allowance of this claim.

Claims 20-29

The Examiner has rejected claims 20-29 under 35 U.S.C. § 103(a) as being unpatentable over Havemann et al., (US Patent 6,130,156) in view of Chiang et al., (US Patent 6,160,315).

Claims 20-29 depend from independent claim 19. Thus, for at least the same reasons discussed above, Havemann in view of Chiang does not render obvious Applicant's invention as claimed in claims 20-29. Applicant therefore respectfully requests the removal of the 35 U.S.C. § 103 rejection of claims 20-29 and seeks an early allowance of these claims

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Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

19. (Amended) A method of forming a Cu alloy, comprising:

depositing a seed layer on a substrate, the seed layer comprising Cu and at least one doping element, wherein the at least one doping element is selected from the group consisting of Al, Mg, and Si;

forming a capping layer over the seed layer;

forming a layer of Cu over the capping layer; and

driving the at least one doping element from the seed layer into the Cu layer.

30. (New) The method of Claim 19, wherein the at least one doping element is Al.